T-T Neutron Spectrum from Inertial Confinement Implosions

JOSEPH CAGGIANO, Lawrence Livermore National Lab, DANIEL SAYRE, LLNL, CARL BRUNE, Ohio University, MARIA GATU JOHNSON, MIT, DENNIS MCNABB, LLNL, ANDREW BACHER, University Indiana (Bloomington) — Measurements of the T(t,2n)α fusion reaction (TT) have been conducted using high-purity (~99 percent) tritium, gas-filled glass capsules in inertial confinement fusion implosions. In these experiments, which were conducted at both the NIF and the OMEGA laser facilities, spectral measurements of the TT neutrons were carried out using two well-established instruments: the neutron-time-of-flight (nTOF) and the magnet-based Magnetic Recoil Spectrometer (MRS). The resolutions of these systems were improved significantly for the nTOF facility by using a crystal with much faster decay time and for the MRS by using a thinner, more uniform CD₂ recoil foil. At OMEGA, charged particle energy spectra were also measured using a magnetic charged particle spectrometer and the Thompson Parabola Ion Energy spectrometer. These measurements at reactant central-mass energies in the range of 10-30 keV can be used to study the TT reaction mechanism near astrophysical energies. This work was reported at the 2013 APS April meeting, where we used basic R-matrix line shapes. Since then we have updated and improved the fitting method by including the proper quantum interferences from fermion symmetry and decay channels [1]. The implications of these effects on our understanding of the spectrum also will be discussed.